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Missoula, Mont.

Poison Oak and Poison Ivy Dermatitis

Prevention and Treatment in Forest Service Work

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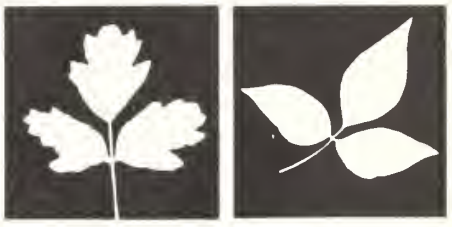

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Abstract

Poison oak or poison ivy dermatitis afflicts outdoor workers in every State except Nevada, Alaska, and Hawaii. The plants are the greatest cause of workmen's compensation in the United States.

Contact with either plant produces identical effects: itching, swelling, and painful blisters. A severe case can be disabling: itching and weeping blisters make sleep impossible; swelling of the face and eyes makes it hard to see; and when legs and groin are involved, it becomes difficult to walk.

The most effective prevention measure is avoidance.

No medicine can completely protect against poison oak/ivy dermatitis. But by understanding it and how it is spread, effective measures can be taken to control it. And now new medications—corticosteroids—can minimize discomfort and speed recovery.

This report describes a method for identifying the most sensitive workers to keep them away from poison oak/ivy areas and details information about the disease: how it is spread, best treatment methods, how it afflicts people, and how it can be avoided. Extensive information is presented for treating the dermatitis in the field or clinic with topical or systemic (both oral and injected) corticosteroids.

A report on Equipment Development and Test Project 9223, Evaluation of Present Prevention Measures for Poison Oak and Poison Ivy, funded by the Safety and Health Group.

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Foreword

Poison oak and poison ivy are common in many areas where Forest Service employees must work. As a result poison oak and poison ivy contact dermatitis is a leading cause of Forest Service field injuries.

Crews fighting forest fires can be particularly vulnerable. Entire crews have suffered skin lesions and severe itching from these plants. Servicewide, the toll in employee suffering and lost work time is substantial.

The solution is education. We must:

- Learn to recognize the plants.
- Determine our sensitivity to the plants.
- Understand how the dermatitis is contracted and spread.
- Keep informed of new medications that can speed recovery and minimize discomfort.

This report will help to accomplish these things. It was prepared for the Forest Service by two leading experts, Dr. William L. Epstein, M.D., and Dr. Vera S. Byers, Ph.D., Department of Dermatology, University of California, San Francisco.

Drs. Epstein and Byers prepared the report under a contract with the Missoula Equipment Development Center (MEDC). They have written one of the most complete evaluations of methods to prevent and treat poison oak/ivy dermatitis.

Their recommendations concern skin testing to identify our sensitivity to the plants, prevention education, protective clothing, and new medical treatments.

Some recommendations will require Washington Office review and direction; sensitivity screening and the administration of certain prescription medicines at fire camps, for example. Most recommendations can be acted on immediately, like those under Prevention Education.

The information in this report will go far to help reduce the number of field injuries caused by poison oak and poison ivy. And the report should dispel much of the ignorance and misinformation surrounding these poisonous plants. In the years to come we should see a significant drop in the number of poison oak/ivy injuries.

A booklet summarizing the prevention and treatment ideas in this report is available from MEDC. It is a handy reference for anyone who must work around poison oak or poison ivy.

Lee I. Northcutt
Director
Missoula Equipment
Development Center

Summary

Poison oak/ivy dermatitis is a serious problem throughout the United States, but particularly in California. The plant grows at elevations below 4,000 feet, and contains a heavy oil called urushiol in the leaves, roots, and stalks. When the leaf is damaged the oil is exposed and can contact the skin. Where the oil accumulates in high enough concentrations it inflames the skin producing the dermatitis.

The oil is not basically irritating, but about 50 percent of the U.S. population is sensitive to it. In sensitive persons their immune system recognizes the oil as "foreign" and mounts an inflammatory response. The earliest symptom is itching. This starts 6 to 24 hours after contact. This is followed by redness and swelling up to 48 hours after contact. Eventually microblisters coalesce forming weepy, itching lesions that can be incapacitating. The intensity of the reaction depends on individual sensitivity and the amount of the oil at each site on the skin.

Although 50 percent of the population is sensitive, about 10 to 25 percent can be called "exquisitely sensitive." This means that persons will react to doses of urushiol less than that contained in one leaf. Sensitive individuals have only about 1 to 3 minutes to wash off the oil. After that, it is absorbed, or bound, to the skin, and dermatitis *will* result if a large enough dose was absorbed. However, excess oil usually remains on the skin. It can be spread to other areas either by direct contact or by touching the area with the hands.

The oil is spread in another important way, through fomites—objects that carry the oil and can transmit it to the skin. Important fomites are hands, tools, and clothing, especially boots, gloves, and shirt sleeves.

The most effective prevention measure is avoidance. This entails education in the plant's morphology, which differs from region to region. Protective clothing is valuable, especially if avoidance keeps exposure low. The main treatment now, as in the past, is washing the skin with cold water and objects that carry the oil with soap and water.

However, two new techniques are available which, if used, should substantially reduce poison oak/ivy dermatitis:

- The first is the ability to screen out "exquisitely sensitive" persons, and to document "low sensitive" or "moderately sensitive" individuals. We predict that such screening will significantly lower the accident reports due to poison oak. Those persons who become ill enough on contact to file an accident report will be screened out.

- The second is the availability of effective and relatively safe steroid gels. These can be applied directly to the dermatitis. If applied early enough, they will eliminate the reaction. The gels have been on the market for about 5 years and are much safer than systemic steroids. Steroid gels are appropriate because a forest worker usually knows when he or she has been in a poison oak/ivy area and can recognize the first symptoms of itching.

The Poison Oak/Ivy Problem

Poison oak and poison ivy dermatitis is the single greatest cause of workmen's compensation in the United States. It afflicts outdoor workers in every State except Nevada, Alaska, and Hawaii where the plants do not grow.

The disease is caused by contact with an oil in the plant called urushiol. The skin inflammation (dermatitis) usually is a local reaction where the oil has touched the skin. Although the oil may spread from one skin area to another, it rarely produces systemic effects. Despite this, it can be completely disabling: Itching and weeping blisters make sleep impossible; swelling of the face and eyes make it difficult to see; and when it involves the legs and groin, it becomes difficult to walk. In rare cases, when smoke-carrying soot coated with the heavy oil is inhaled, the effects become systemic. The result is fever, malaise, and tracheitis and bronchitis besides the dermatitis.

Firefighters and trail crews run a great risk of developing the dermatitis because of their high exposure. For example, a review of employee accident reports for 1977 on the Los Padres National Forest in California shows that 310 of the 690 accidents reported involve poison oak. This certainly represents only the tip of the iceberg because only the most severe cases are reported. The common attitude is to consider the dermatitis part of the job.

Accident reports are distributed about evenly between workers carrying out project work and firefighters. Nevertheless, firefighters have long been recognized as having a special problem with the dermatitis: First, they cannot avoid the plant. At night they cannot see it and during the day firelines must be cut through vegetation whether or not it contains poison oak or ivy. Second, they have a much higher chance of contacting the oil in smoke. They are in some type of smoke much of the time. Often high winds increase the chance of getting a blast of oil-containing soot and smoke in the face and inhaling it. Such cases produce much more serious effects than direct plant contact.

No "medicine" will protect workers from developing the dermatitis. But by understanding the disease and how it is spread, simple, effective measures can control it. And a new medicine is available for its treatment. This report discusses the disease and methods of prevention and treatment. It includes the measures available to ameliorate the dermatitis among both firefighters and others who face a high risk of contacting poison oak and ivy.

Urushiol Oil

Poison oak or poison ivy grows in almost every State, usually at elevations below 4,000 feet. The leaves vary in morphology from region to region, but are usually as shown in figure 1. The dermatitis is produced by an oil in the sap of the plant. This oil is called urushiol. It is present in the leaves and the stem and roots. It is not present in the berry or the pollen.

The sap is not normally found on the undamaged leaf; the plant must be damaged for the sap to contact the skin. Uninjured leaves are not harmful. Although this is an academic point under most conditions of exposure, it does emphasize the fact that when the plants are being cut, the most toxic part is the cut end of the stem, and the crushed leaves. Potency of the plant may vary at different times of the year, but it is not enough to make a difference in the reaction of sensitive individuals.

The oil is heavy, and is not aromatic or gaseous. Thus, the old wives tale that one can get poison oak/ivy dermatitis by standing near the plant is not true. However, when the plant is burned, the heavy oil coats the soot, and this airborne material is dangerous to people downwind from the fire. It can often produce severe dermatitis. This is relevant both to firefighters and to picnickers standing downwind of a campfire.

A common way of acquiring the dermatitis, apart from contact with the plant, is through fomites. Objects that can carry the oil—clothes, tools, equipment, animals, etc.—are fomites. The soot mentioned above would be a fomite. Another important fomite is animal fur. Most animals do not actually get the dermatitis, but their fur carries the oil, spreading it to humans. Shoes or boots worn through a patch of poison oak and coated with the oil can remain contaminated for several months and cause dermatitis upon contact. The oil slowly becomes inactive by oxidation or polymerization (described later). So the oil may remain active on gloves or shoes for months, possibly years. Articles contacting the plant should be carefully washed with soap and water.

It is not true that water flowing over poison oak will produce the dermatitis (if the water is fast moving) because the oil is only slightly soluble in water. Also, dissolved oxygen probably inactivates the oil present. However, slow moving water carrying soil from the plants, such as the muddy water seen in a flash flood that has drained through the patches of poison oak, will produce the dermatitis.

Figure 1.—(a) & (b) Western poison oak (*Toxicodendron diversilobum*)—California; (c) Poison ivy (*Toxicodendron radicans*)—Florida; (d) Poison ivy (*T. rydbergii*)— Idaho.

Urushiol belongs to a class of chemicals called alkylcatechols (fig. 2). The catechol ring is coupled to a sidechain of 15 or 17 carbons. These may be mono, di, or triunsaturated. The catechol ring is critical for "activity." If that portion of the molecule is altered, activity is lost. No dermatitis results. This is thought to be because the small molecule must be covalently bound to a large protein to be active. The mechanism by which this occurs involves the oxidation of the catechol ring to a quinone, which can then bind to proteins or cells.

Although the alkylcatechols in poison oak urushiol have more C-17 sidechains, and those in poison ivy urushiol have more C-15 sidechains, both plants are cross-reactive. This means that a person who is sensitive to one, is just as sensitive to the other.

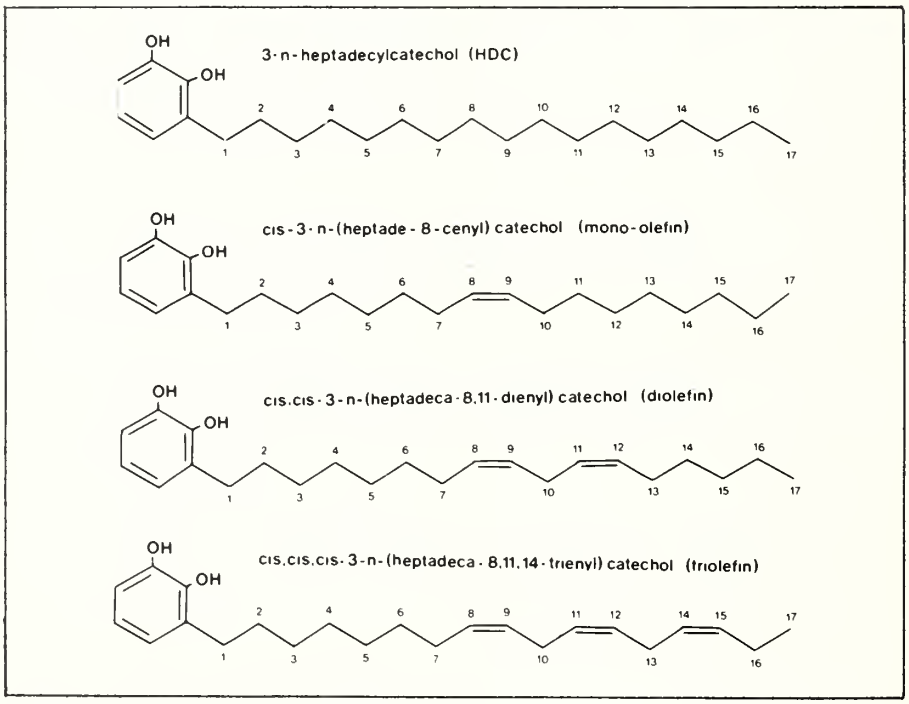

Figure 2.—Alkylcatechols in poison oak urushiol.

The diunsaturated sidechains are more potent (antigenic) than the saturated sidechains. But urushiol oil contains little of the saturated sidechains, so this is not clinically important.

When the catechol ring oxidizes to the quinone, it can bind to proteins and produce the dermatitis. Or it can polymerize with other catechol molecules and become inactive. This is one way by which the oil on a fomite, such as a shoe, can slowly become inactive. This polymerized material is black. Often it can be seen on the plant leaf.

The Dermatitis

Poison oak sensitivity is like an allergy—one is not born with it. Children younger than 5 years rarely are sensitive because they have not encountered the plant. Between 5 and 10 years of age they usually contact the plant, probably requiring several exposures before the dermatitis appears, and probably requiring relatively large doses at first. After that, small amounts trigger the inflammation. The first series of exposures before the dermatitis appears is called sensitization. It is much easier to sensitize children than adults. If persons are not sensitized as children the chances are they will avoid sensitization as adults.

When the urushiol oil contacts the skin it penetrates through the top layer of the epidermis and binds to skin cells. The immune system recognizes these cells as "foreign" and proceeds to destroy them. Basically the reaction producing poison oak or ivy dermatitis is similar to that by which cancer cells or virus-infected cells are destroyed.

It has been suggested that the inappropriate reaction is due to a case of mistaken identity. The immune system "thinks" the cells carrying the urushiol are cancer cells. The reaction is inappropriate, because people who are not sensitized, or those who are incapable of being sensitized, can get the oil on their skin with no ill effect. The oil itself is not toxic except in very high concentrations.

The reaction is also immunological (allergic) because the first several exposures to poison oak produce no dermatitis; the immune system must first learn to recognize the alkylcatechol bound to the skin. Once this occurs, later exposure to even small amounts of the oil provoke the dermatitis. The severity of the reaction depends both on the sensitivity of the victim and the amount of oil.

This reaction is called a "delayed hypersensitivity reaction" because it appears 24 to 48 hours after exposure. Before 24 hours most people show no indication of exposure.

There are three phases to the reaction:

1. The area becomes red and swollen.

2. After about 48 hours microblisters begin to form and coalesce.

3. By about 72 hours the entire area is covered with large blisters that are very itchy and begin to weep. The weepy phase lasts about 4 days, then slowly begins to resolve.

The dermatitis can persist for 2 to 3 weeks after exposure. The intensity of the dermatitis and degree of suffering depends on: size of the skin area involved; location of the dermatitis; and amount of oil that initiated the reaction.

Those three phases are different because of the different types of white blood cells (lymphocytes) present during each phase. During the first 24 hours the T lymphocytes converge on the area. They begin producing and releasing proteins called lymphokines that call macrophages into the area. These macrophages in turn contribute to the swelling. Mast cells in the tissues activate and release chemicals that dilate the blood vessels. Finally, after about 48 hours, another type of white cell, called a basophil, enters the area. These basophils begin to degranulate, releasing chemicals such as histamine and other mediators. These cells may actually produce the damage, characterized by the blisters.

Depending on the sensitivity of the individual, the oil can be washed off the skin with cold running water 1 to 3 minutes after exposure with no ill effects. After that time, the oil binds to the skin or is absorbed by it, and the dermatitis cannot be prevented.

The excess unbound and unabsorbed oil is still present and can be spread to other areas. This is often seen as a rash appearing one place on the body the second day and another place the third day. To prevent dermatitis from spreading, the skin should always be washed immediately after contact. Once the excess oil is washed off, the dermatitis cannot be spread; neither the red swollen area nor the blister fluid can transmit it.

Conditions that worsen the dermatitis:

- **Heat**—allows better penetration of the oil into the skin. Produces vasodilation that augments the migration of white blood cells into the area. Cold markedly decreases dermatitis.

- **Humidity**—increases sweating, allowing oil to spread in the sweat.

- **Occlusive Dressings**—allow oil to penetrate better.

Determining Sensitivity

About 85 percent of the U.S. population can be sensitized to poison oak/ivy. But only about 50 percent are clinically sensitive, meaning that they react to contact with the plant. This is largely because different people require different amounts of the oil to produce a reaction; their level of sensitivity varies.

This variability is shown in figure 3, in which the reactivities of different people were tested. The test is called a patch test. The urushiol oil is diluted in acetone, and a standard amount is dropped onto the forearm. The acetone evaporates and the urushiol is left on the skin.

If several different dilutions of the oil are used, one can get an idea of how sensitive the individual is. For example, in the series of experiments represented in figure 3, five different concentrations of urushiol in micrograms—0.5, 1.25, 2.5, 5.0, 50.0—were applied to the forearm of volunteers. At the end of 48 hours, each site was read as positive or negative, and given a grading as to the intensity of the reaction. All sites were about the area of a nickel, because that was the size of the spot of acetone. The sites were red with blisters, red and swollen, only red, or free of any reaction.

Reactions from a typical patch test are shown in figure 4. The practical value of this test is that 2 micrograms of urushiol oil is about the amount that would come from one leaf crushed on the skin. It can be seen that 40 percent of the people reacted to this. This correlates well with the number of individuals who develop the dermatitis when they contact the plant.

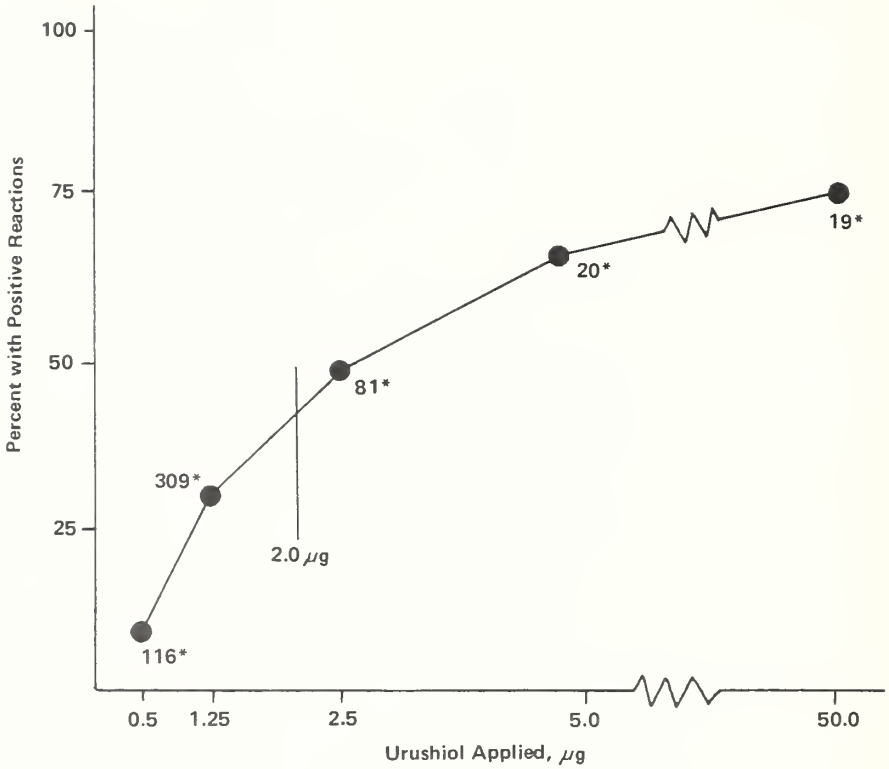

Figure 3.—Percentage of subjects with positive reactions, at various dilutions of urushiol in acetone. The 2 micrograms intercept falls at 40 percent, which is approximately that noted by others using other patch testing materials. Asterisk indicates number of subjects tested.

Figure 4.—Typical reactions from a patch test.

Using this method, the test population, which is considered representative of the United States, can be divided into four groups:

1. The first are people who are not sensitive to poison oak. These individuals do not even react to 50 micrograms of the oil. Any higher dose would produce a "burn" because of local irritation, and would probably never normally be encountered. Because these are adults, if they are not sensitive now, they probably will not become sensitive. They compose 15 to 25 percent of the population, depending on the study.

2. The next group are people who are mildly sensitive. They require amounts greater than 2 micrograms to react. They would develop the dermatitis if they were exposed to oil of more than one crushed leaf at one site, or if the area contacted was placed under an occlusive dressing. But under normal circumstances, their reaction would not be severe. This group composes another 25 percent of the population.

3. Then come the individuals—25 to 50 percent—who are moderately sensitive, meaning that they react to 2 micrograms but not lower.

4. Last, are the 10 to 25 percent termed exquisitely sensitive. They will react to amounts smaller than 1 microgram. The dermatitis produced by one leaf will be quite intense.

Obviously these sensitivities can change with time. In general, persons repeatedly exposed to poison oak become more sensitive and will react to lower concentrations. Individuals who do not encounter poison oak for several years become less sensitive. Also, people become less sensitive as they get older.

However, these rules are not invariable. A person who used to be able to wade through patches of poison oak can suddenly develop a severe case of dermatitis after his or her usual contact. Conversely, occasionally, after a serious bout of poison oak a person becomes less sensitive. The best approach is simply to repeat patch testing each year for individuals who need to know how sensitive they are.

Most people can recognize poison oak dermatitis, and can describe how serious the reaction was. However, for the most part, these histories are only valuable because they indicate sensitivity. They do not indicate *how* sensitive, because moderately sensitive individuals may perceive themselves to be exquisitely sensitive after accidental exposure if (1) the dose was large; (2) the area of contact was subsequently occluded; (3) the area was large, or in a sensitive site; or (4) the dermatitis was tolerated poorly.

It is true that black people are somewhat less sensitive than white people.

General Prevention Steps

Education and Avoidance

The best way to prevent poison oak/ivy dermatitis is to recognize the plant and avoid it. However, its appearance varies from region to region. So education programs must use local plants as examples.

The best way to recognize the plant is to see it in its natural habitat. Photos or drawings are a poor substitute. But most education programs start there, using five pictures showing not only the characteristic morphology and color of the plant, but also the surroundings in which it is found. The plant changes color in the autumn, becoming brightly colored, and this type of picture should be included.

Protective Clothing

Any type of protective clothing is better than none. But protective clothing has drawbacks. If the oil gets on the skin and in sweat under protective clothing, the clothing itself can spread the oil both directly and by promoting sweating. Also the clothing can act as an occlusive dressing to increase penetration of the oil into the skin. These matters can best be determined by actually examining cases of poison oak dermatitis encountered while wearing the clothes.

Identifying Fomites

Next to direct contact, fomites are the major source of the dermatitis. Fomites include the skin itself, which can pass off unbound oil to other areas, as well as the fingernails, which can trap the oil and spread it over the body. Clothing and tools can remain contaminated for months and should be washed well with soap and water.

Systemic Prophylaxis

It is possible to hyposensitize individuals to poison oak by giving them urushiol capsules each day for 6 months. The dose is initially small and gradually increased. This method is impractical for both the general population and firefighters. It only confers protection for a few months after the oral feedings have stopped, and the side effects during the procedure require the patient to be under a dermatologist's care. Also, patients are not protected from poison oak; they are merely made less sensitive.

Placebo

In the past, many over-the-counter (OTC) preparations have been used to combat poison oak dermatitis. OTC preparations such as "Immuneoak" or "Ivyol" attempt to provide the type of systemic prophylaxis described above. Carefully controlled trials carried out by the Food and Drug Administration (FDA) demonstrated that these preparations contain such small amounts of active material that they are without value in objective prophylaxis. However, they do produce a placebo effect. This effect is much more powerful than its name indicates; a rather stable value of 30 to 40 percent response is obtained in widely different clinical trials ranging from hyposensitization to poison oak through various types of cancer therapy. Regardless, the OTC preparations will not be available in the future because they are being taken off the market. Aspirin as a placebo may occupy a valuable position in treatment of dermatitis.

Barrier Creams

Clinical trials have found petroleum jelly ointments to be as effective as any of the other barrier creams, but none are very good. If nothing else were available for prevention or treatment, such ointments might be considered. But they are so unpleasant to use, that patient compliance is very low, and their use is impractical.

Treatment

Water and Soap

Urushiol oil is marginally soluble in water, but can form micelles that help it spread. So a little water spreads the dermatitis, but a lot will wash it off. Using soap is controversial. It is superior to water alone in removing the oil. But it removes the skin lipids that protect against absorbing the oil; these take 3 to 6 hours to regenerate. If skin is washed with soap and water, then reexposed within this period, either from new contact or from oil spread from other parts of the body, the dermatitis could be worse. So it is probably best not to use soap. The water should be cold. Warm water allows the oil to penetrate more and causes vasodilation, increasing circulation and bringing more white cells into the area.

Detoxicants

Various chemicals have been suggested as detoxicants, including zirconium, iodine, sodium perborate, and potassium permanganate, for their oxidizing capabilities. None have proved significantly more effective than water.

Corticosteroids

Corticosteroids (also called corticosterone or steroids) are the main treatment for severe cases of poison oak. They can be given topically in gels, or systemically either as intramuscular injections or orally as pills. They work by depressing the immune system. Because the skin damage is caused by the immune system, damage and continuing inflammation are prevented. The earlier they are used the better as far as minimizing the reaction. They are quite effective if used 24 to 48 hours after the contact when the area is red and swollen. The redness and swelling will be eliminated within hours and no microblisters will be formed; 48 to 72 hours after contact, steroids are effective in preventing the reaction from getting worse, but the blisters that have already formed require the usual time to heal.

In considering steroid therapy it is important to understand the side effects. Treatment with steroids for up to 1 week usually causes no side effects in normal individuals. Treatment longer than that can depress the immune response. The body becomes more susceptible to infections and can allow silent infections such as tuberculosis to become symptomatic. Also, it alters the normal way the body regulates salt, water, and sugar and requires medical examination and supervision. Physicians consider steroids very potent and administer them with care.

The best way to take advantage of them without evoking the damaging side effects is to keep the total dose *low* and the period of use *short*. When steroids are indicated they first should be used topically if possible, then systemically.

Topical Steroids. Within the past several years, steroid gels have been developed that absorb well into the skin. They effectively prevent dermatitis from developing or from getting worse once the blisters have appeared, and they are the preferred treatment. Steroid creams, lotions, and ointments are also available but not recommended. Gels deliver a high potency steroid more efficiently to the skin so that it can be used over a short period of time on acute dermatitis and achieve real therapeutic effect.

The gel is rubbed into the affected skin several times a day. Improvement can be seen in about 6 hours. It produces no adverse side effects as long as it remains local on the skin; for example, both forearms. Some of the gel is absorbed into the systemic circulation in amounts directly proportional to the amount applied topically. So topic application must be carried out in moderation.

Steroid gels are currently marketed under the brand names Topsyn, Uticort, and Benisone. Topsyn has the higher concentration of the steroid than the other two.

Systemic Steroids. Systemic administration of steroids is by intramuscular injection or by pills. This more potent form of the medication is indicated when:

- The dermatitis involves more than one-quarter of the body.
- Exposure was in smoke as indicated by a red and swollen face.
- A very sensitive person contacts the oil and face or genitals begin to itch and swell.

Itching is usually the earliest symptom, followed by swelling and redness. Again, the earlier the steroids are administered the better. If a sensitive individual has been in a poison oak area and begins to itch over large areas of the body, systemic steroid therapy is indicated. The medication is either given as one injection or pills taken over 24 hours. Both approaches produce marked improvement in hours.

If the reaction has progressed only to the itchy, red, swollen stage, the symptoms quickly clear. If it has gotten to the microblister stage, the redness and swelling resolve, but the blisters clear in the usual time. However, new blisters do not form.

Other Medicines

Basophils release histamine, and theoretically antihistamines such as Benadryl or Chlor-Trimeton should help in the treatment either of the dermatitis itself or of the itching. However, neither topical nor systemic application of antihistamines has been proven effective. Any positive benefit derived from these agents is probably because they make the patient sleepy.

Calamine Lotion

This topically applied lotion is not pharmacologically active and is probably as good at relieving itching as anything, apart from steroids. It is especially effective when applied to areas where blisters have formed because it relieves the itching and also absorbs the blister fluid. Colloidal oatmeal has a similar action and may be used in baths.

Placebo

Aspirin is a good placebo.

Poison Oak/Ivy Dermatitis and the Firefighter

To determine the types of firefighter exposure, two series of records were reviewed. The first were the accident reports for the years 1977-79 at the Sierra National Forest Supervisor's Office, Fresno, Calif. The second were the accident reports for the same period at the Los Padres National Forest Supervisor's Office, Goleta, Calif. A large part of the Sierra National Forest is above 4,000 feet, and those fires involved little poison oak. Most of the Los Padres National Forest is below that elevation, and poison oak is a serious problem.

Review of the Fresno records indicated that: Almost 100 percent of the sites were forearms; about 75 percent also included face; about 60 percent eyes; 60 percent included abdomen; and about 20 percent included legs. Most contacts occurred because fireline was cut through a stand of poison oak.

Investigation of these reports indicated that the plant contacted the arms, followed by wiping the sweaty forehead with the sleeve, thus rubbing across the eyes. Interestingly, there were no reports of dermatitis on the hands. This indicates that the gloves provide protection for the hands and do not form an occlusive dressing.

The Goleta records differed from the Fresno records primarily in the severity of the dermatitis. Firefighters encountered severe poison oak both while firefighting and while constructing fuel breaks. At least one of the cases was due to contact with the oil in smoke; this could be seen both by a description of the dermatitis, and by the supervisor's comment. Almost every report listed the arms as involved; most listed the face also. A higher number of legs were involved here than in Fresno for unknown reasons. Again, the hands were not mentioned as sites of the dermatitis.

Prevention

Education and Avoidance. The types of exposure experienced by firefighters is unusual in two respects. They cannot be educated to avoid the plant, because firelines must be cut along predefined lines without regard to foliage. Also, the high winds created by the fires combine with the smoke to create conditions under which the soot and smoke particles serve as a fomite. Anyone downwind will not only be hit in the face with the material, but also can inhale it, producing tracheitis and pneumonitis.

Interviews with firefighting crews and supervisors uniformly indicate that the usual firstline prevention measure, that of education and avoidance, is not applicable during a fire. Most firefighters and supervisors are adept at recognizing the plant during the day; they know when they are in an "oak area." Apart from the fact that much of the firefighting effort is carried out at night, however, it is not possible to change the course of a fireline to avoid an area of poison oak or ivy; both morale and time considerations make it mandatory to clear through, not around, such an area.

It is only possible to avoid exposure entirely by not being on the fireline. Or alternatively an individual may avoid exposure by dropping out of the fireline when going through heavy poison oak areas. Both of the procedures would be feasible if individuals knew what their sensitivity to the oak is.

As described in the introduction, the intensity of the reaction is a function both of the dose and extent of the contact, and also of the sensitivity of the individual. A patch test—a quick, simple procedure—to define individual sensitivity is described earlier. Applying the test drops on the forearms takes about 2 minutes. Positive reactions result in a red swollen area the size of a nickel, and can be read in 48 hours by the patient himself.

Individuals being given the step test as a prerequisite for firefighting also could be patch tested with two to three different concentrations of urushiol in acetone. The tests would be read either by an experienced observer or by the patient, and would be used to classify the candidate as exquisitely sensitive, moderately sensitive, mildly sensitive, or not sensitive.

The 10 to 15 percent of candidates read as exquisitely sensitive should not be chosen for this duty. All reports indicate that in a fire in poison oak areas, anyone who *can* get poison oak dermatitis *will* get it. So exquisitely sensitive persons fighting a fire will be more of a liability than an asset. They probably will have to be transported away from the fire within 24 to 48 hours, and may be incapacitated for 1 to 3 weeks thereafter.

A moderately sensitive person should have the option of either electing to stay clear of the firelines when the supervisor determines the crew is entering heavy oak areas, or, if there are not enough personnel to allow this, take particular care to put on additional protective clothing.

Protective Clothing. Apart from a person's sensitivity, the inadequacy of protective clothing worn by firefighters is probably the most important contributor to the dermatitis. The legs, feet, and hands appear to be adequately covered, as indicated by the relatively low number of reports of dermatitis in these areas. However, most reports list the forearms and arms as a principal site of the dermatitis, and most include the face and sometimes the eyes. The reason for this is that the shirts and gloves leave the forearms completely bare. When wielding a pulaski or when picking up brush these areas are exposed. Also, the urushiol gets on the outside of the shirt sleeves, which are then used to wipe the eyes; and on the inside of the sleeves when the firefighter straightens up, and is spread up the arms both by direct contact and by being dissolved in the sweat.

It is not acceptable to lengthen the gloves; this would make them hotter and more unwieldly. One suggestion is to lengthen the sleeves so the forearms are not exposed. Another is to produce a cotton wrist guard, extending midway up the forearm that might be impregnated with a hydrophobic resin to soak up the urushiol oil. This would protect the forearm from contact with the oil and also soak up the sweat, minimizing spread of any oil present. The wrist protectors could be carried in a packet to be worn when in "oak areas."

The problem of facial dermatitis is more difficult. One solution is to minimize the sweat rolling into the eyes with a sweatband around the head under the hardhat. Such bands might be made of a dull khaki, or of white terry cloth, to indicate their practical nature and distinguish them from the brightly colored headbands often worn by the convicts who form part of some of the crews.

Another suggestion is to equip all firefighters with a pocket handkerchief that can be tied over the nose and mouth, and is long enough to wipe the brow.

Wash-Off Site With Water. The importance of water in preventing the dermatitis has been described. Unfortunately, the oil can only be washed off within a few minutes after contact. After that time the site of *primary contact* will develop the dermatitis. However, excess oil may remain on the site for hours, and can spread. So liberal use of cold water on the affected areas is strongly recommended to prevent spread. Under present conditions this can only be done at base camp.

The forearms and face appear to be the areas of highest contact. This should be emphasized to the firefighters, and hand-washing should extend up the forearms. If water is available at the fire site it should be used liberally.

Fomites. The primary fomites appear to be the sleeves and gloves. If possible, the shirtsleeves should be rinsed at night. Ideally, the gloves should be rinsed in soap and water periodically to remove most of the oil. The two problems with this suggestion are the lack of water at the fire site and the nature of the glove, a porous suede, from which it would be very difficult to remove the oil. Therefore, if water cannot be made available, some other means of wiping the face might be used, such as a handkerchief.

Another important fomite is the boots, and certainly the importance of washing these with soap and water at base camp should be emphasized. The pulaski is another fomite carrying high concentrations of the oil that are easily spread. The importance of other fomites cannot be determined without testing. However, sleeping bags would be a potential source of spread and certainly should be cleaned after each fire.

Systemic Prophylaxis. As discussed, the oral administration of urushiol oil to produce hyposensitization is not feasible under normal circumstances. The procedure is long and requires a physician's care. It might be suitable for exquisitely sensitive individuals, but they would be wise to avoid the fireline altogether.

Placebo. Many forestry personnel, especially firefighters, are required to take "drops" of poison oak/ivy extract that they are told will hyposensitize them. Although the compliance is variable, apparently the feeling exists that these drops do some good. They are only placebos, and any effect is due to the powerful "placebo effect" described earlier. All such "drops" will be taken off the market by the FDA within the next year or two, so it is not necessary to discuss whether ethical and moral consideration would militate for or against their use. It should be noted, however, that aspirin also constitutes a powerful placebo that is available for use in the first aid kits.

Barrier Creams. Barrier creams are not effective and are not recommended.

Decontaminants. Ordinarily, cold running water serves as the best decontaminant. When water is not available decontaminants might be considered, but in fact, a steroid gel is preferred.

Treatment

1. Because a lot of water washes off the oil, and a little water spreads it, the treatment of choice is immediate washing with cold running water. Soap probably should not be used on skin, but should be used on fomites.

2. Decontaminants have not been proven more useful than soap and water. Rather than carry decontaminants in first aid kits, additional water should be made available.

3. Steroid gels applied *topically* will prevent the dermatitis if used within the first 24 to 48 hours after contact. It is also very effective if used prophylactically. However, prophylactic use is not advised, because such extensive use of steroid gels applied topically during the duration of a 1-week fire could allow a high systemic dose to accumulate.

Accordingly, fire supervisors should be supplied with tubes of steroid gels, to be dispensed to those who have the early signs or symptoms of poison oak dermatitis: itching, redness and swelling of the forearms or neck, or isolated patches on the face. If large areas of the face are involved, systemic steroids —such as pills or shots—should be recommended.

Oral steroids should be provided at base camp to medically trained persons capable of administering shots or drugs. Many fires will not have such trained people. The victim of poison oak involving more than one-quarter of the body or swelling of the face or genitals should report to an emergency room and request treatment with steroids. A dermatologist is not needed, as both the victim and any physician will readily identify the lesions on the basis of appearance and history and treat accordingly.

4. Calamine lotion can be used along with steroid gels to relieve itching and ameliorate the weeping blisters. It should be used *instead* of steroid gels when the area of contact is small, or when the dermatitis is more *than 72 hours old; steroids are not useful* at this time but symptomatic relief is desired.

Timber and Wildlife Activities

The second major "at risk" population for poison oak/ivy dermatitis in the Forest Service are those who work in the field on various timber and wildlife projects, for example, timber stand improvement, wildlife openings, tree planting, and timber cruising and marking.

Beyond the standard hardhat, most of these workers wear a wide variety of shirts, trousers, and jackets. To accomplish their jobs, workers must move into the forest where they contact underbrush and trees.

Humidity and heat are the major considerations in determining exposure. They not only exacerbate the dermatitis, but also workers tend to wear as little as possible. No accident records were reviewed for this group.

Trail and Campground Maintenance

Maintenance crews run high risk of exposure to poison oak/ivy dermatitis, as their work is usually carried out in areas below 4,000 feet.

Personnel are composed either of seasonal workers such as college students, or of "volunteer" workers, largely taken from the Young Adult Conservation Corps (YACC). Some permanent employees also are assigned to this duty. It is estimated that YACC personnel compose about 40 percent of the trail maintenance crews. Turnover is so high that the time of employment should be estimated to last only one season for each person.

Exposure to poison oak is to some extent avoidable with these crews, especially compared to the firefighters. Nonetheless, the number of accident reports in 1979 and part of 1978 amounted to about 55 out of 110 surveyed. Data are not available on the exposure rate of these trail maintenance crews (numbers of subjects involved in this duty and number of days worked) compared to the firefighters, and this data would be difficult to obtain. However, discussions with Forest Service personnel indicate that the orientation of these workers is very short. No special effort is made to acquaint them with the appearance of poison oak. Often in the accident reports special mention was made both of the fact that the subject was a YACC member, and that protective clothing was being worn at the time of exposure.

The conclusions from this are:

1. A disproportionately high level of poison oak dermatitis occurs among YACC workers, compared to the total number of workers on these jobs. YACC workers compose 30 to 40 percent of the workers but account for about 50 percent of the accident reports among the trail crews.

2. Accident reporting among maintenance workers is quite high. It accounts for 50 percent of total exposures, even though contacts certainly are more avoidable than for firefighters.

3. Protective clothing is not helpful if workers do not attempt to avoid poison oak/ivy.

Recommendations

Sensitivity Screening

1. Develop patch test kits containing single-dose delivery aliquots of urushiol oil in acetone in three amounts, 1, 2, and 5 micrograms, all in a volume of about 5 microliters.

At least 10 percent of the men and women involved in jobs with the Forest Service involving high risk of exposure to poison oak, poison ivy, or poison sumac are probably "exquisitely sensitive" to the plants. These people also probably account for multiple accident reports. We recommend testing for such employees before they are assigned to "high risk" jobs. The tests can be in the form of kits, containing one-dose delivery aliquots of 1, 2, and 5 micrograms urushiol in acetone. The test can be applied in 5 minutes and requires no medical training for application. It should be read 48 hours later. The classification should be:

Classification	Test Results	Significance
Very sensitive	Reacts to 2 micrograms and 1 microgram	Will react to less than one leaf
Moderately sensitive	Reacts to 2 micrograms but not 1 microgram	Will react to one leaf crushed on skin
Mildly sensitive	Only reacts to 5 micrograms, but not to 2 micrograms or 1 microgram	Requires more than oil from one leaf at the same spot to react
Not sensitive	Does not react to 5 micrograms	Probably will not react to encounters with poison oak, ivy, or sumac

All subjects would be tested to 1 and 2 micrograms. Subjects would also be tested with 5 micrograms if they say they have *never* had poison oak or poison ivy dermatitis. Perhaps firefighters could be tested when they are given the step test. The "very sensitive" (exquisitely sensitive) people should not be assigned to jobs involving high risk of poison oak/ivy contact. The "mildly sensitive" and "not sensitive" could be assigned to such jobs, but cautioned to wear protective clothing. The "moderately sensitive" could be assigned to those jobs if necessary, and cautioned about protective clothing. They could be provided with steroid gels through their supervisor.

2. Train supervisors or other personnel in how to administer and read the tests.

3. Classify personnel on the basis of test results as to their job assignments, and on precautions against poison oak/ivy dermatitis.

Prevention Education

4. Notify each tested person of his or her sensitivity with an explanation of what that means. For example, a moderately sensitive person who has been through oak areas should attach more significance to itching than a mildly sensitive person.

5. Make education in the local morphology of poison oak and poison ivy mandatory for all Forest Service personnel and show each recruit the live plant in the field. Use a series of four photographs, perhaps on pocket-sized cards, as the best alternative way of learning the plants: one closeup of the plant *in that region* when it is green; another of the plant turning orange or red; and two of the plant in its usual surroundings.

6. Instruct workers to rinse exposed skin, especially forearms, with plenty of cold water after working in oak and ivy areas. Although this will not prevent the dermatitis of the primarily affected skin, it will prevent its spread. A serious problem here is lack of water at a fire site. Ample water would do more to reduce the spread of urushiol over the body than any barrier creams or decontaminants. Water at the base camp is essential, but much of the damage has been done by the end of the work period when workers can obtain it.

7. Educate employees about the potentially important fomites—gloves, boots, tools, sleeping bags, and clothes—and the nature of the heavy oil that remains on them, and why and how they should be cleaned. For example, if boots are taken off with the hands at night, the hands carry the oil to the face and body during the night, and the dermatitis results. Boots should be washed at base camp with soap and water. Clothing and sleeping bags should be laundered after each fire.

Protective Clothing

8. Lengthen the sleeves of the Nomex shirts, or provide removable terrycloth wrist and forearm bands, at least 5 inches wide, to wear over the forearms in "oak areas."

9. Consider supplying either a sweatband for the forehead, a terry-cloth band for around the hardhat liner, or a handkerchief for carrying in a pocket to firefighters and other employees working in oak and ivy areas. Consideration should be given to a glove with a smooth surface, that could be rinsed. (All of these are aimed at providing some other method of wiping sweat from the forehead instead of using gloves or sleeves. The gloves are probably the most important fomite; their rough surface not only holds the oil, but also makes it difficult to remove.)

Treatment Education

10. Inform all forestry workers that *new* drugs, which are very potent, are available to cure poison oak/ivy dermatitis. Relief depends on early detection. The earliest symptom is itching, followed by redness and swelling, and then blister formation. At the first sign of itching, a person who has been through an oak or ivy area should apply for steroids. The decision as to whether they should be given topically or systemically will be made by a trained person, perhaps the supervisor.

Criteria for Topical Steroids. Less than one-quarter of the body involved, less than one-half of the face involved. *Topical* steroids should be issued as gels in 10- to 15-gram tubes. There should be enough on hand to treat sensitive crewmembers who have been exposed and as soon as they complain of itching, redness, or swelling. Treatment should begin at first symptom; it *should not extend beyond 3 days, or after the blisters develop.* The gel should be used sparingly and rubbed into the skin thoroughly. No visible gel should remain on the skin. The supervisor should demonstrate use—it is difficult to describe.

Criteria for Systemic Steroids. More than one-quarter of the body involved; one-half or more of face; genitals swollen; encounter of oil in smoke. *Systemic* steroids can either be delivered as:

Tablets—20 delivered in divided doses over a 24-hour period, 5 tablets 4 times a day—approximately every 6 hours. Either prednisone (5 mg/tablet) or Decadron (dexamethasone) (0.75 mg/tablet can be used). Prednisone is cheaper, but its effectiveness depends on the supplier; some are good, some are bad. Decadron is a Merck Sharp & Dohme product, consistently effective, but more expensive. These pills can be given at base camp.

Injections—If the dermatitis breaks through in the next 24 hours, victims should go to an emergency room. They should have a card instructing the physician to give two injections of (a) Celestone (betamethasone sodium phosphate and betamethasone acetate) 1 ml at 6 mg/ml and (b) Kenalog-40 (triamcinolone acetonide) 1½ ml at 40 mg/ml.

11. Alternatively, if the Forest Service prefers not to provide steroids at base camp, the victim can be counseled to visit an emergency room at the earliest symptoms and receive the same two injections.

12. Develop a card, signed by an appropriate physician, that carries instructions to an emergency room physician and also contains information about poison oak/ivy dermatitis.

13. Use calamine lotion for symptomatic relief. It should be supplied in the first aid kits. It should always be provided *without* additives such as Benadryl or zirconium.

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Appendix

(Chemically Relevant References from *Chemical Abstract Search)*

Treating poison ivy dermatitis using certain polyamines and polytertiaryamides.

Author: Tomalia, Donald A.; Dickert, Yancet, J.; McCarty, Leslie P.

Location: USA

Section: CA001006 Publ Class: PAT

Journal: U.S. Coden: USXXAM Publ: 780905 Pages: 3 pp.

Patent No: 4112067 Applic No.: 769479 Date: 770217

Class: 424-78. A61K31/74

Assignee: Dow Chemical Co.

Identifiers: Rhus dermatitis polyamine polytertiaryamide

Selective oxidative cleavage of poison ivy hydrourushiol and related 3-N-alkylcatechols.

Author: Thomas, Charlotte Ann

Location: Univ. Mississippi

Selection: CA003001. CA001XXX. CA004XXX Publ Class: DISS

Coden: DABBBA Publ: 76 Pages: 120 pp.

Citation: Diss. Abstr. Int. B. 1978. 39(3), 1269-70.

Avail: Univ. Microfilms Int., Order No. 7815578

Identifiers: pyrocatechase poison ivy treatment, hydrourushiol poison ivy oxidn, catechol alkyl poison ivy

Lacasse-catalyzed polymerization of urushiol in precisely confined Japanese lacquer system.

Author: Kumanotani, Je

Location: Inst. Ind. Sci., Univ. Tokyo, Tokyo, Japan

Section: CA042003 Publ Class: JOURNAL

Journal: Makromol. Chem. Coden: MACEAK Publ: 78

Series: 179 Issue: 1 Pages: 47-61

Identifiers: laccase catalyst urushiol polymn, Japanese lacquer urushiol polymn

Poison ivy and poison oak treatment using hydrophilic anion exchange material.

Author: Rathbun, William B.

Location: USA

Section: CA001006 Publ Class: P

Journal: U.S. Coden: USXXAM Publ: 751125 Pages: 4 pp.

Patent No: 3922342 Applic No: 358,1000 Date: 730507

Class: 424-79, A61K

Assignee: University of Minnesota

Identifiers: poison ivy treatment anion exchanger

Tetraalkyldiamides for treatment of poison ivy.

Author: Windeheuser, John J.

Location: USA

Section: CA063006 Publ Class: P

Journal: U.S. Coden: USXXAM Publ: 750401 Pages: 4 pp

Patent No: 3875301 Applic No: 465,527 Date: 740430

Class: 424-45, A61KI

Assignee: Interx Corp.

Identifiers: alkyldiamide poision ivy treatment, diamide alkyl poison ivy treatment, methylsuccinamide poison ivy treatment

Treating the skin for relieving symptoms caused by poison ivy and poison oak.

Author: Crary, Ely J.

Section: CA063006 Publ Class: P

Journal: U.S. Coden: USXXAM Publ: 750121 Pages: 3 pp.

Patent No: 3862331 Applic No: 350,702 Date: 730413

Class: 424-331, A 61K

Identifiers: poison ivy oak treatment butanone

Dermal protective film.

Author: Cardarelli, Nathan F.: Mansdorf. Seymour Z.

Section: CA063006 Publ Class: P

Journal: U.S. Coden: USXXAM Publ: 730731 Pages: 3 pp.

Patent No: 3749772 Applic No: 95,412

Class: 424-81, A 61K

Assignee: University of Akron

Identifiers: skin protective polyacrylate, acrylate polymer skin protective, dermatitus treatment polyacrylate

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